

Enzymes

Mark Scheme 2

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 2

Time Allowed: 66 minutes

Score: /55

Percentage: /100

	Answers	Marks	Guidance for Examiners
1 (a) (i)	amylase ;	[1	
(ii)	pH is a factor that influences / affects enzyme activity / AW; to give the optimum pH ; extreme pH could denature enzyme / AW ;	[max 1]	ORA
(b)	<i>idea that protease , would break down, enzymes / enzyme 2 ;</i>	[1	
(c)	stable at high temperatures / does not denature at 60 °C / optimum temperature near 60 °C ;	[1]	I bears / tolerates hot temperatures I heat resistant I ref to denatures > 60 °C
(d)	<ol style="list-style-type: none"> 1 (bacteria grown in) fermenters ; 2 (bacteria provided with) substrate / food (substances) / glucose / minerals / whey / waste substances / nutrients / culture medium / AW ; 3 oxygen / aerobic conditions ; A air bubbled through 4 (bacteria) grow / reproduce / increase in number ; 5 enzymes, secreted / released / AW ; 6 enzymes separated from, bacteria / mixture ; A ref to filtration 7 AVP ; e.g. conditions – 26 °C / pH 5–6 	[max 3]	A extracted by crushing bacteria
(e)	extracts more juice / speeds up juice extraction ; pectin converted to sugars ; so juice is sweeter ; cell wall material is removed from juice / pectin digested to soluble product(s) ; so the juice is clearer ; AVP; humans don't produce pectinase i.e. humans can digest the juice.	[max 3]	I easier.....
		[Total:10]	

2 (a)	<p>K – plumule ; L – radicle ; M – cotyledon ; N – testa ;</p>	[4]
(b)	hypha(e) ;	[1]
(c)	<p>MP1 substrate, ‘fits’ into enzyme ; MP2 active site (of enzyme); MP3 shape is complementary ; MP4 substrate is key, enzyme is lock ; MP5 substrate / starch / nutrient, converted (into products) / AW ; MP6 (2) products (molecules) lea ; MP7 enzyme / amylase, can work again on another substrate ;</p>	[max 4]
(d)	<p>very little activity until day 5 ; increase to day 11 / peak at day 11 ; decrease to day 15 ; data quote with day <u>and</u> activity ;</p>	[max 3]
(e)	<p>ref to different shapes of the lines ; (therefore) there is enzyme activity in both pH ; enzyme activity influenced by / specific to, pH ; data quote ; e.g. quote of activity at pH 8 <u>and</u> pH 5 on a specified day ; suggesting one enzyme prefers acid conditions, but by day 15 less enzyme, produced / available ;</p>	[max 3]
		[Total: 15]

Question	Expected Answers	Marks	Additional Guidance
3	<p>(a) <i>substance that</i></p> <p>speeds up a chemical reaction ; not changed during the reaction ;</p>	[2]	
	<p>(b) (i) <i>ideas that</i></p> <p>temperature is not a variable being investigated ; temperature is a factor that affects enzyme action ; 30 °C, optimum temperature / enzymes work best ;</p>	[max 2]	A temperature is a control variable
	<p>(ii) as control(s) ; <i>tube 5</i> to show that urea does not breakdown without enzymes ;</p> <p><i>tube 6</i> to show that beans are not source of pH change ;</p>	[max 2]	
	<p>(iii) soya and jack beans have urease ; mung and broad beans have no urease ; mung and broad beans may have low concentration of urease ; jack beans have more urease than soya beans ;</p>	[max 3]	A more active

3	(c)	converted to, nitrite (ions) / nitrate (ions) ; by nitrifying bacteria ; absorbed by plants ; vapourises ; donates hydrogen ions ; (hydrogen ions from ammonium ions) reacts with lime in neutralised (in this context only) ;	[max 2]	
	(d)	(i) (gastric juice contains) hydrochloric acid ; low pH ; kills bacteria / stops them dividing ; AVP ;	[max 2]	
		(ii) urease produces ammonia ; neutralises, stomach acid / hydrochloric acid ;	[2]	
		(iii) <i>lymphocytes secrete</i> antibodies ; phagocytes engulf bacteria ;	[2]	
			[Total: 17]	

Question	E	Answers	Marks	Additional Guidance
4	(a)	amylase ; prote(in)ase ; lipase ;	[3]	R carbohydrase R trypsin / pepsin / peptidase R 'protase', A 'proteas'
	(b)	1 prevents spread of (named) disease / AW ora ; 2 avoids pollution / removes harmful substances ; 3 makes, water / sewage / effluent, safe / AW ; 4 avoids smells ; 5 recycling of water ; 6 AVP ; e.g. ref. to eutrophication	[max 1]	A removes harmful microbes / bacteria R 'germs' A examples no need to specify for whom or what it is safe, but R 'safer' unqualified, treat 'marine organisms' as 'aquatic'
	(c)	1 mixes microorganisms with sewage ; 2 good contact between microorganisms and solids ; 3 more collisions ; 4 (aerobic) respiration ; R if anaerobic respiration 5 microorganisms produce carbon dioxide ; 6 gain / release / transfer, energy ; 7 (for) growth ; 8 (for) reproduction ; 9 to make enzymes ; A ref. to digestion	[max 4]	A microbes / bacteria
	(d)	to start the breakdown of the sewage quickly ; continuous process ; do not have to, breed / buy, the microorganisms ; <i>idea of</i> without waiting for the lag phase ;	[max 3]	A 'the right organisms to digest the sewage' A ref. to cost / less wastage of microbes A keeps the population of microbes constant <i>idea</i> R 'to save time' unqualified R 'to use over and over again'
	(e)	destroys / kills, bacteria / microorganisms ; prevents spread of, disease / pathogens ; makes water suitable for drinking ;	[max 2]	R disinfection R 'removes bacteria'
			[Total: 13]	